

WING AND TAIL MOLT IN THE REEVES PHEASANT^{1, 2}

CHARLES F. MUELLER³ AND HENRI C. SEIBERT

Department of Zoology, Ohio University, Athens, Ohio

ABSTRACT

In the Reeves Pheasant, the 10th juvenal primary is retained throughout the first winter. Adult males start their primary molt two months earlier and complete it three weeks earlier than do the females. There are 18 rectrices in both juveniles and adults, but the molt is centrifugal in the former and centripetal in the latter. Adult males start their rectrix molt one month earlier, and complete it one and one-half months earlier than females.

INTRODUCTION

In the last twenty years, there has been much work done on the molts and plumages of gallinaceous birds. Studies on the Ring-necked Pheasant, *Phasianus colchicus*, (Buss, 1946; Trautman, 1950; Woehler, 1953; Westerskov, 1957), the California Quail, *Lophortyx californicus*, (Raitt, 1961), and the Hungarian Partridge, *Perdix perdix*, (McCabe and Hawkins, 1946), were conducted with the aim of establishing criteria by which the birds might be aged. No such work has as yet been published on the Reeves Pheasant, *Syrmatiscus reevesii*. The objectives of this study were to determine, for primaries and rectrices, the time, order, and rate of ecdysis and endysis in adults and juveniles for both males and females.

The literature on the Reeves Pheasant is limited. Most of what is known of its basic biology in its homeland of north-central China has been given by Delacour (1951) and Beebe (1918). Delacour also presented data on the plumage patterns and relative lengths of the primaries and rectrices. Petrides (1945) mentioned the molting of the tenth primary. Recently this species has become familiar to wildlife workers in various states as attempts have been made to introduce this exotic as a possible game bird.

METHODS

On April 26, 1963, the first of a series of weekly plumage measurements was taken on 27 one-year-old birds kept at the Waterloo Wildlife Experiment Station, New Marshfield, Ohio. The birds were housed in cages 10 x 15 x 6 feet, with 12 cages holding both a male and a female each, and 3 cages holding only a single male each. Measurements were continued through December, 1963.

Two groups of 24 newly hatched chicks were obtained from the Waterloo Wildlife Experiment Station, the first on May 8, 1963, the second on June 12, 1963. To help reduce feather breakage from pecking and crowding, the birds were placed in individual cages measuring 20 x 12 x 12 inches. Standard rearing procedures were followed (McAtee, 1945), with food and water always available. On June 19, the birds of the earlier hatch were banded and removed from their cages and allowed the freedom of a 10 x 15 x 8-foot brooder house and attached exercise yard. Those in the second hatch were removed from their cages on July 16 and housed in a second, similar unit. Despite all precautions, throughout the course of study, there was a constant loss of birds with measurable feathers due to sickness, fighting, predation, and feather breakage. Newly hatched chicks were measured three times a week until three weeks old, twice a week until September 15, 1963, and once a week until June, 1964.

The innermost primary was considered number 1 and the outermost, number

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³Present address: Department of Zoology and Entomology, Montana State University, Bozeman, Montana.

10. Rectrices were numbered 1 through 9, with the innermost being number 1. The left wing and left half of the tail were measured.

Measurements were taken with a caliper and ruler from the tip of a feather to the skin surface. A feather was identified as having completed its growth by pulp breakdown in the rachis.

All birds used in the study were descendants of a shipment of Reeves Pheasants which had been trapped from a wild French population and sent to the Waterloo Wildlife Experiment Station in 1959.

RESULTS

Dates of feather appearance and feather loss are based on averages for all birds for which information is available. Since there was a constant loss of birds, data from the first stages of the study are based on a larger number of measurements than data from later portions.

All data on juvenal feathers and on feathers of the first winter plumage are based on measurements of the two groups of birds. To determine whether growth rates of the two groups were comparable, means and standard deviations were found separately for each group. All means of the first group fell well within two standard deviations of the second group, so data from the two groups have been lumped.

Juvenal Plumage

At hatching, the first seven primaries of both males and females were present. Little difference was found in the lengths of these feathers, the first 6 being approximately 9 mm while the 7th was 5 mm. The 8th primary appeared on the 8th day after hatching, the 9th primary on the 16th day, and the 10th primary on the 28th day. Feathers completed growth in an orderly, sequential fashion, from the first through the 10th primary. The 10th primary completed growth on the 102nd day for males and on the 109th day for females.

TABLE 1

Lengths, standard deviations, and age at completion of male and female juvenal primary growth

Primary	Length of male primary (mm)	N	Avg age when completed (days)	Length of female primary (mm)	N	Avg age when completed (days)
1	76±2	24	29	68±2	24	27
2	83±2	20	29	75±2	21	29
3	99±3	20	34	90±2	20	35
4	106±5	19	34	102±3	20	39
5	114±4	17	40	109±1	18	36
6	114±4	17	40	109±1	16	38
7	115±3	16	40	113±2	14	44
8	115±3	14	44	114±4	13	47
9	138±6	13	72	130±3	11	73
10	152±4	11	92	131±4	11	91

Males had consistently longer mature primaries than females (Table 1). The differences of the means ranged from 1 mm in the 8th primary to 21 mm in the 10th. Sexual differences in feather lengths were least in measurements of the 5th, 6th, 7th, and 8th primaries.

Juvenal primary 1 was dropped on the 27th day after hatching (average) in males and on the 25th day in females. Molt proceeded in a sequential fashion from primary one through nine in both sexes, with females molting slightly earlier on the average. Primary 9 was molted at 114 days in males and at 119 days in

females. The 10th juvenal primary was not molted during juvenal molt, but was retained throughout the first winter and was lost at the first post-nuptial molt.

At hatching, none of the rectrices was present, but they appeared during the 12th day in both sexes. Among females, the completed 2nd rectrix was longest (118 mm), and rectrix 9 was shortest (45 mm). Unfortunately, upper size limits of the 1st, 2nd, and 3rd male rectrices were based on only one bird, whose feathers were rather worn and therefore did not give an accurate indication of the total length. All rectrices completed growth between 40 and 60 days after hatching.

Rectrix molt covered a much shorter time period than did molt of primary feathers, lasting approximately 20 days. The second rectrix molted first; molt proceeded in a generally centrifugal pattern, with rectrix 9 molting on the 70th day. Because of molt abruptness, it was impossible to determine its exact order for all feathers. There was no statistical difference in age between males and females when these feathers were lost.

First Winter Plumage

The first winter plumage was similar in pattern and coloration to subsequent adult plumages except for the retention of the 10th juvenal primary.

In all cases there were approximately three days between the loss of the old and the appearance of a new feather.

The first male adult primary appeared on the 26th day (average) after hatching; the next 8 primaries appeared in succession, with the 9th primary appearing

TABLE 2
*Lengths, standard deviations, and age at completion of male and female primary growth,
1st winter plumage*

Primary	Length of male primary (mm)	N	Avg age when completed (days)	Length of female primary (mm)	N	Avg age when completed (days)
1	135±5	17	69	121±4	17	58
2	153±4	17	74	141±2	16	66
3	173±8	15	84	154±2	15	75
4	180±6	13	96	160±5	15	87
5	190±8	12	110	169±1	12	102
6	194±5	10	123	171±2	10	118
7	184±2	9	128	*172±0	8	125
8	184±4	7	149	161±5	7	139
9	168±3	5	168	152±5	4	162
10	**152-4	11	**92	**131-4	11	**91

*Based on two birds.

**Juvenal primary.

on the 116th day. Female primaries followed the same general pattern, with the primary 1 appearing on the 26th day and primary 9 on the 112th day. In both sexes, the time interval between the appearance of successive primaries increased. For example, only 8 days elapsed between the appearance of the 2nd and 3rd male primaries, while 18 days elapsed between the appearance of the 8th and 9th primaries.

Total lengths of completed feathers are shown in Table 2. Males had consistently longer primaries compared to females, with the 6th primary being the longest. Primary 7 appeared to be the longest in females; however, data on this feather are not sufficient to draw any conclusions.

All rectrices of both males and females appeared between the 50th and 70th days of age. In both sexes, the 1st rectrix was longest and the 9th rectrix shortest.

Length of the 1st male rectrix, based on two birds, averaged 965 mm. The second male rectrix, based on only one bird, was approximately 820 mm.

Molt dates of the primaries and rectrices of the first winter plumage are based on 27 one-year-old birds during the spring and summer of 1963. By the 26th of April, the date of the first measurement, 11 of the 16 males had already lost their 1st primary (fig. 1). Some had lost their 1st primary at least one week, and perhaps as much as two weeks, earlier. Most females did not molt their first primary until the 10th of June, approximately two months later. Males lost their primaries consistently earlier than the corresponding primaries were lost in the females, although the differences in dates became less as molting advanced. All males completed their primary molt by the 5th of September, and females completed molting their primaries by the 25th of September.

It was impossible to determine the exact order of tail molt, since two or more rectrices would drop during a week, but it was clear that molt began with the outer rectrices and moved toward the center of the tail, whereas in a juvenal molt the direction was reversed. Male rectrices began molting in early June, with all rectrices having molted by the 5th of July. Female rectrices started molting in late June, with molting continuing to the last week of August.

Second Winter Plumage

The 1st male primary appeared on the 24th of April (average) and the 1st female primary appeared on June 4th. The 9 remaining primaries appeared in an orderly sequential fashion in both sexes. The 10th male primary appeared on the 30th of August and completed growth in 15 days. Female primary 10 appeared on the 14th of September and had completed growth by the 14th of November. Completed lengths are shown in Table 3. The differences of the means of the

TABLE 3
Lengths, standard deviations, and date of completion of male and female-primary growth, 2nd winter plumage

Primary	Length of male primary (mm)	N	Avg date of completion	Length of female primary (mm)	N	Avg date of completion
1	150±5	15	Jun 14	133±5	12	Jul 30
2	164±6	14	Jun 19	145±8	12	Aug 6
3	177±5	13	Jun 30	156±3	10	Aug 14
4	185±4	12	Jul 17	168±3	9	Aug 26
5	194±5	11	Aug 1	173±1	8	Sept 7
6	198±3	8	Aug 23	173±1	5	Sept 19
7	197±4	7	Sept 13	170±4	5	Sept 27
8	191±1	6	Sept 21	164±3	5	Oct 12
9	179±2	6	Oct 12	153±1	4	Nov 4
10	161±1	5	Oct 29	136±3	4	Nov 14

primaries ranged from 4 mm to 15 mm in males and 2 mm to 12 mm in females.

Male rectrices all appeared between the 30th of May and the 5th of July, the innermost rectrices appearing last. The female rectrices appeared between June 23 and August 1. All rectrices were completed, for males by December 7 and by October 28 for females.

During the spring of 1964, the birds on which the figures in the section are based were checked by us and were found to be in stages of molting comparable to the first post-nuptial molt.

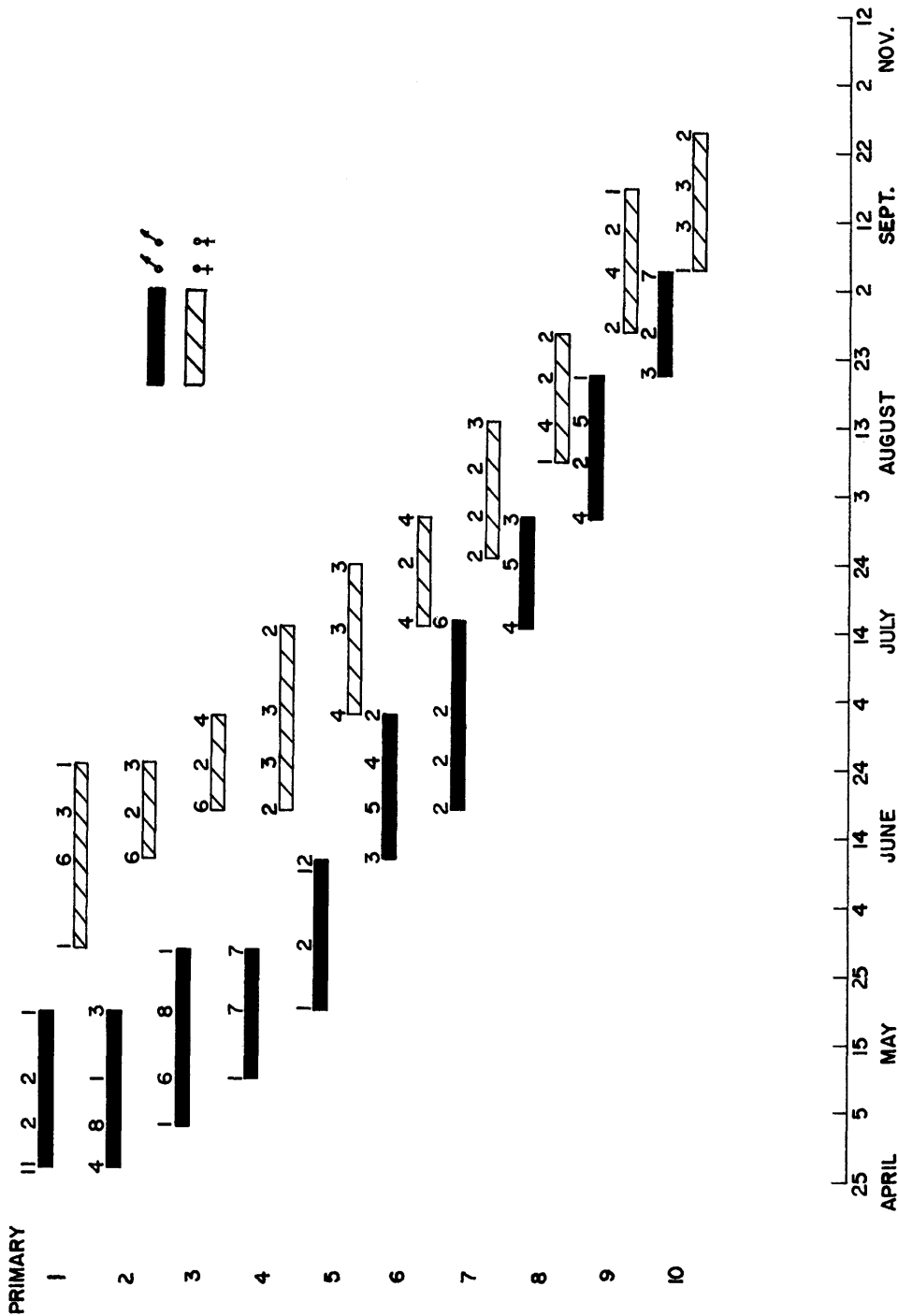


FIGURE 1. Dates of loss of male and female primaries of the first winter plumage. Numbers above the bars represent the number of new birds molting by that date.

DISCUSSION

The Reeves Pheasant appears to be similar to some other gallinaceous birds in having 7 juvenal primaries present at hatching, with the 8th, 9th, and 10th primaries appearing at later, more variable times (Raitt, 1961; Salomonsen, 1940; Westerskov, 1957). The 10th primary of the Reeves Pheasant did not appear until the 28th day, in agreement with the known date for the Ring-necked Pheasant (Trautman, 1950).

The ages at which the first four primaries are lost are similar in Ring-necked Pheasants and Reeves Pheasants. However, outer primaries molt later in the Reeves Pheasant, with differences increasing toward the distal end of the wing. For example, the 6th primary molts at 63 days in the Ring-necked Pheasant, and at 73 days in the Reeves Pheasant. The 9th primary molts at 91 days in the Ring-necked Pheasant, and at 118 days in the Reeves Pheasant.

Petrides (1945) showed that there was a complete post-juvenal molt in the Ring-necked Pheasant. This has been found to occur in other members of the subfamily Phasianinae, with the exception of partridges, which retain both outer primaries during the first winter (Friedmann, 1930). The results of this study indicate that the 10th primary of both sexes is retained through the first winter, contrary to the statement by Petrides (1945) that there is a complete post-juvenal molt in the Reeves Pheasant.

The female juvenal primaries were found to molt consistently earlier than the male primaries. This is in agreement with Buss (1946), who noted that juvenile Ring-necked hens molted their primaries earlier than the males.

The published descriptions of the tail molt in the Ring-necked Pheasant (Westerskov, 1957; Trautman, 1950) agree with that of the Reeves Pheasant except for the direction in which it occurs. In the juvenile Reeves Pheasant, the molt progresses generally from the center of the tail to the outside, while in the adult, the tail molt begins with the outer feathers and progresses toward the center. Differences of the same nature have been noted between juvenile and adult See-See Partridges (Marien, 1951) and Hungarian Partridges (McCabe and Hawkins, 1946).

Contrary to the observation by Delacour (1951) that the Reeves Pheasant has 20 rectrices, only 18 rectrices were found in both juvenile and adult birds of both sexes.

No pre-nuptial molt was observed in the Reeves Pheasant.

The Ring-necked Pheasant hen begins the primary molt in early July, following the hatching of her brood (Bent, 1932; Buss, 1946; Kabat et al., 1950). Her molting stage has been shown to be comparable to the stage of molting in her brood (Kabat et al., 1950). This condition has also been demonstrated in other members of the Galliformes (Stempel, 1960; Raitt, 1961). The female Reeves Pheasant molts the first primary in early June and the next three by the first of July. Since all eggs were collected and the hens not allowed to rear any broods, it is not known if the molt of the hens can be correlated with the hatching date of her brood.

The wing molt of the Ring-necked Pheasant cocks is said to begin in early June, approximately one month in advance of the hen's molt (Kabat et al., 1950). All the male Reeves Pheasants, however, had molted at least 4 primaries by early June. The primary molt in most males started in the middle of April, almost two months before that of the females.

SUMMARY

The growth, sequence, and date of molt of the juvenal and of the first winter wing and tail feathers of the Reeves Pheasant (*Syrnaticus reevesii*) were established. Measurements were made on 50 chicks and 27 adult birds over a one and a half year period.

Seven primaries were present at hatching; the next three appeared by the 30th

day of age. Juvenal primary molt started on the 26th day of age and continued through the 120th day. The 10th juvenal primary was retained throughout the first winter and lost at the first post-nuptial molt, and not at the post-juvenal molt as reported in the literature. The 18 juvenal rectrices appeared on the 12th day and were all molted between the 50th and 70th days after hatching. Juvenal tail molt appeared to progress generally from the middle of the tail to the outside.

The 9 new primaries of the first winter plumage were all present by the 116th day. All rectrices appeared between the 50th and the 75th days. By the 26th day of April, 11 of 16 males had lost their first primary of the first post-nuptial molt. Females did not start molting their primaries until the middle of June, approximately two months later than males. Males completed their primary molt by early September, females by late September. The male rectrices started to molt in early June and continued into late August. Adult rectrices molted centripetally. Both juveniles and adults have only 18 rectrices.

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